

Rationale for Weather Station Location

Port Townsend Paper Corporation

From Agreed Order NO. 5771:

2. PTPC shall, within 120 days of the execution of this Agreed Order, install and operate a continuous meteorological station on the mill site. The proposed location of the meteorological station and the rationale for this location shall be provided to Ecology for review and approval within 60 days of the execution of this Agreed Order. The meteorological station shall measure and record ambient temperature, wind speed, wind direction, relative humidity, and barometric pressure. The wind direction and wind speed shall be accessible on the internet.

I. Site Selection

Port Townsend Paper relied on the knowledge of trained Instrument Technicians, the manufacturer, and several other resources when selecting the location of our RainWise MK-III RTI-LR weather station. Port Townsend Paper employees qualified Instrument Technicians to manage, implement, and maintain a wide variety of highly technical instrumentation throughout the mill. The technicians have experience with many types of instrumentation, and this knowledge was helpful in selecting the location of the weather station. In addition, Port Townsend Paper's Instrument Shop was directly involved in the siting of our existing anemometer. The instrument and environmental staff reviewed several potential locations for the weather station. The Instrument Technicians' experience with similar instrumentation led to the conclusion that many areas of the mill could result in poor measurement of weather should the instrument be placed there. In other words, many of the tall structures could result in rain, wind, or sun shadows, whereas some areas of the mill could create a wind tunnel effect. Likewise, the selected location should minimize poor readings due to falling leaves, dust or other debris. Finally, the weather station operates on solar power and transmits data via radio frequency. Hence, the station had to be in a location to provide the needed solar radiation and to allow minimal signal interference. The roof of the warehouse dock was selected because it is free from interference and obstructions. The warehouse itself is one story high, which will minimize wind effects, and there are no obstructions to block measurement of rain or wind or to affect the radio signal. The station was placed there shortly after being purchased, and a comparison of wind data to our existing anemometer at the primary clarifier building shows good agreement. Finally, we chose a location that would allow safe access to the weather station for maintenance.

II. Manufacturer Guidelines

The following was taken from "Instructions for the RainWise MK-III RTI-LR Weather Transmitter," available on www.rainwise.com. Port Townsend Paper Corporation's Instrument Technicians used these guidelines when placing the station.

A word about location and instrumentation:

In order to obtain accurate measurements from the MK-III-RTI-LR it must be correctly located. For accurate wind readings the MKIII RTI-LR should be mounted so that it is not obstructed by an structures or trees. If the unit is to be mounted on a roof, it should be at least 2 ½ feet above the roof line. The station should also be mounted in a location where it will receive the maximum amount of sun exposure. Avoid locating the station near any heat sources such as chimneys or vents. If possible avoid mounting the station above large dark surfaces that may heat up in the sun. If you are mounting the station on a roof, try locate it as close to the edge as possible.



Regardless of how you mount the system, the bottom of the electronic enclosure should not extend more than 12" or less than 7" above the support of the mounting tube.

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The MK-III-LR has a range in excess of a mile. This range is based on an unobstructed true line of site installation. Actual range will vary depending on the installation. Trees, structures, walls (including glass) will reduce this distance. The closer you can keep the transmitter to the receiving devices the better. Always test the range before making the final installation. In most cases a range of 400 to 500 feet does not present any issues.

We also suggest that you operate your system at ground level and make sure that it operates properly prior to installation. Consult the instructions for your display and/or computer interface.

1. Mount the support tube as indicated above. Insert the necked down end into the **MKIII** sensor assembly, until it bottoms with the retaining screw in the slot. Tighten the screw.
2. Rotate the assembly until the solar panel faces TRUE SOUTH, TRUE NORTH if you are in the southern hemisphere. Secure the support tube to the assembly from rotating.
3. Adjust the solar panel angle for optimum performance. Use the table below to determine your optimum angle.

Latitude	Panel Angle (from vertical)
0° - 22.5°	60°
22.5° - 55°	30°
55° - 90°	15°

III. Federal Guidelines

Port Townsend Paper reviewed “Federal Standards for Siting Meteorological Sensors at Airports,” published by the Office of the Federal Coordinator for Meteorological Services and Supporting Research (Department of Commerce) and information about the Citizen Weather Observer Program (CWOP), a public-private partnership between weather observers and the National Oceanic and Atmospheric Administration (NOAA). A summary of these guidelines is as follows:

A. Atmospheric Pressure

The sensor usually should be installed in a weatherproof enclosure, avoiding areas that are affected by pressure changes caused by compression (e.g., closing doors, vibration, and rapid temperature changes). The sensor should not be in direct sunlight or be subject to drafts from windows or HVAC systems. It should be at least 3 feet above ground level, but less than 100 feet above average terrain.

The RainWise assembly provides such protection of the pressure sensor, and the location is not subject to mechanical vibration, routine jarring, unnatural air flow, and is located 35 feet above sea level.

B. Wind Speed and Direction

The sensor should be oriented to TRUE NORTH, not magnetic north. The site should be relatively level or on a gradual slope. This sensor should be mounted about 30 feet above average terrain and at least 15 feet above any obstruction within 500 feet.

The site is level and there are no obstructions.

C. Temperature and Dew Point

The sensor should be at least 5 feet above ground level and be adequately ventilated but needs protection from direct sunlight and heat. Vegetation near a sensor should be clipped to 10 inch height or less.

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The sensor is at a sufficient height, is protected by a radiation shield, and there is no vegetation nearby.

D. Rain Gauge

The precipitation collector must be level and the surrounding terrain should be as flat as possible. It should be as close as possible to ground level, and free from obstructions. It should not be placed so that water may splash onto the sensor or near non-precipitation sources of water (e.g., sprinklers). To avoid losses due to wind, install an "alter-type" wind shield. In areas with rain or sub-freezing temperatures, it must be heated to measure snow or freezing rain. Rain gauges should be checked periodically to ensure sensor is free of debris.

The rain gauge is level and near a rooftop. The location does not allow for water to splash into the gauge or otherwise enter it outside of precipitation. The assembly is in a location convenient for maintenance and far from sources of debris.

IV. Weather Underground

Port Townsend Paper purchased the RainWise weather station with software that allows data to be transmitted to the Internet, including the potential to transmit it to the popular weather web site, Weather Underground (www.wunderground.com). Weather Underground has recommendations (in *italics*) on siting weather stations:

A. Temperature

When placing your weather station, make sure:

- *the thermometer sensor never receives direct sunlight*
- *the thermometer receives plenty of ventilation (it is not blocked from the wind)*
- *if the thermometer is placed above a roof-top, make sure it is at least 5 feet above the roof-top*
- *if the thermometer is placed above grass, again, it should be at least 5 feet above the grass surface*
- *the thermometer is at least 50 feet from the nearest paved surface*

Suggestion: use a radiation shield for your thermometer. This way, your weather station can be placed in direct sunlight, with the thermometer located inside the radiation shield.

The RainWise weather station includes a radiation shield. The passive solar shield for the temperature and humidity sensors are modeled after the ones designed by the National Weather Service and are thus protected from interferences that the above recommendations are designed to handle.

B. Humidity

Humidity measurements should reflect the humidity of the general atmosphere in your location.

- *make sure your humidity sensor is at least 50 feet from the nearest tree or body of water*

The station is at an elevation of 35 feet, on our warehouse dock. Because the mill itself is on Glen Cove, the proximity of the weather station to the water reflects actual conditions.

C. Rainfall

You want the rain collector (or rain gauge) to receive rainfall as if it were in the middle of a large field. Nearby buildings create "shadows"....A good rule of thumb:

- *the rain collector...should be placed with at least 5 feet horizontal clearance to the nearest obstruction*
- *if a nearby obstruction is just over 5 feet away, that obstruction should be no more than 10 feet tall*

The instrument has been placed in a location free from obstructions.

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D. Wind Speed & Direction

Similar to the rain collector, the anemometer should reflect the wind patterns as if the instrument was placed in a large field:

- *the standard wind measurement should be taken at 10 meters (33 feet) above the ground. A roof-top works best. Try to place the anemometer as high as is convenient.*
- *try to make the anemometer the highest object around. 7 feet or more above surrounding obstructions is best.*

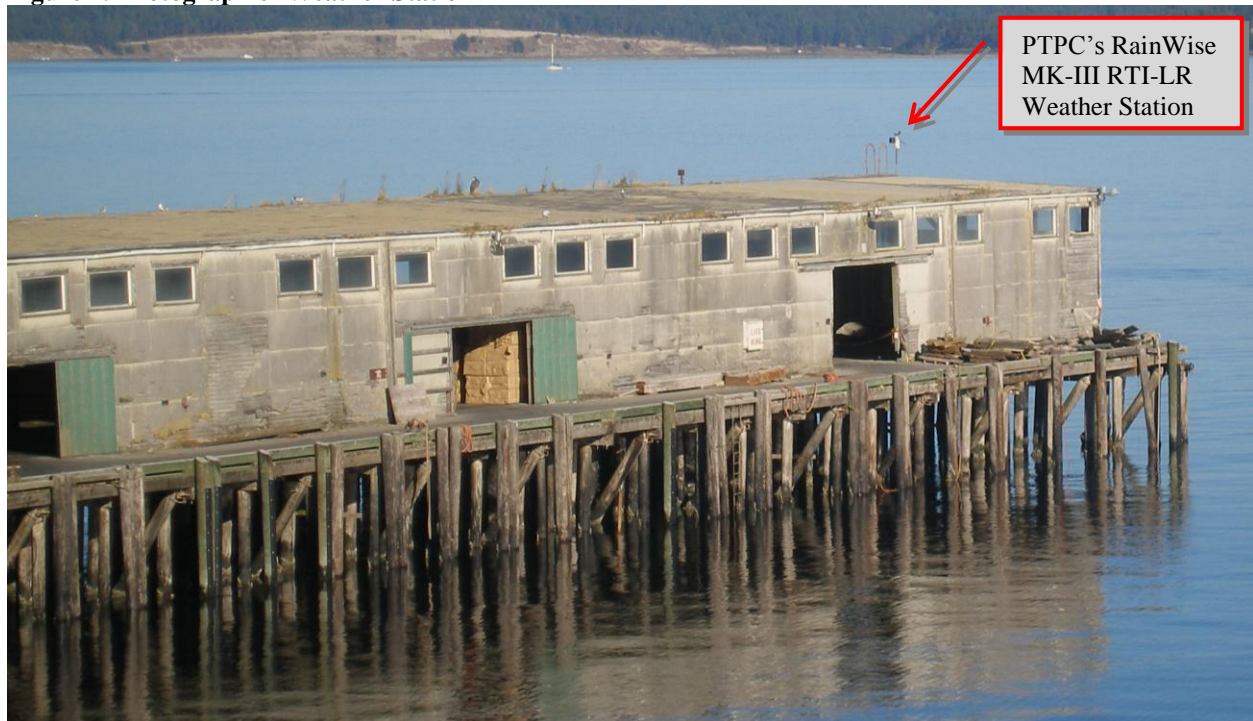
The instrument has been placed in a location free from obstructions, at a height of 35 feet above sea level, mounted on top of a rooftop-access ladder guard rail.

V. Other Resources

We reviewed recommendations from other weather station manufacturers and weather observers. In general, the guidelines stated in Sections I-IV above are universally recommended, and no new factors were introduced in other literature.

VI. Location Depictions

Figure 1. Photograph of Weather Station



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Figure 2. Weather Underground / Google Image Showing Location

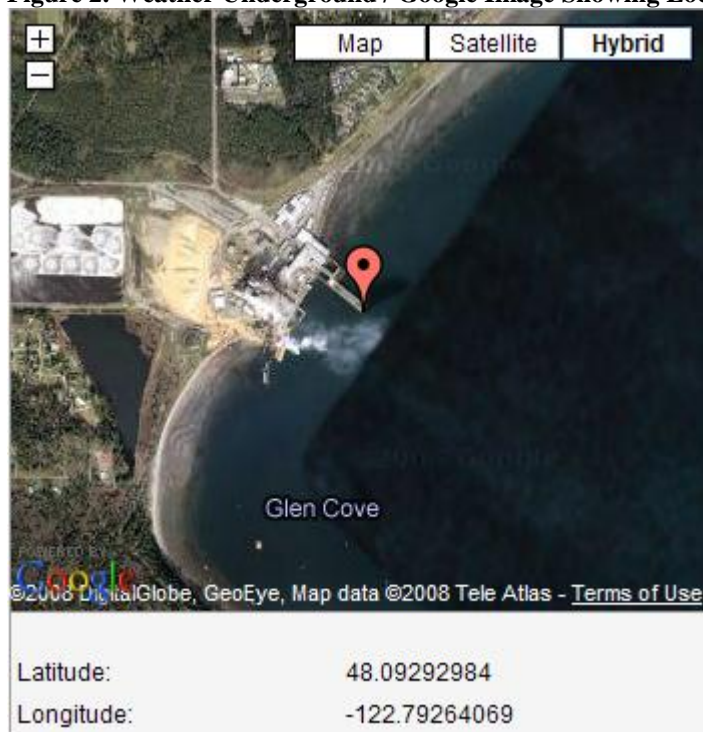


Figure 3. Site Map Showing Location Relative to Mill Site

